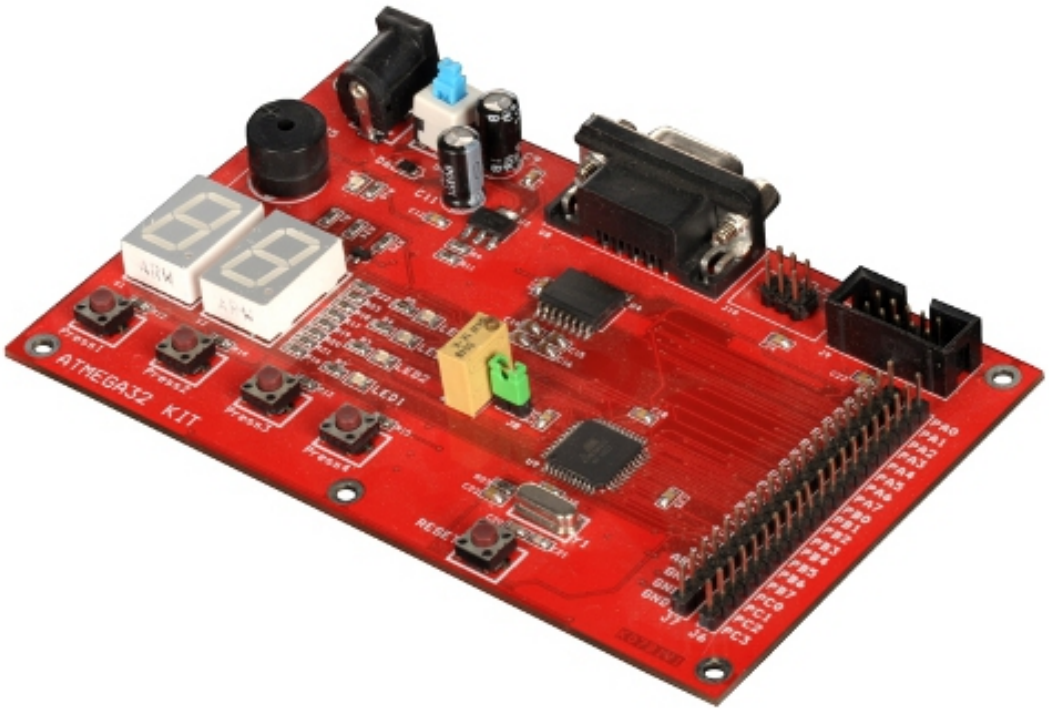
ATMega32 Kit - User Guide

K07B1V1



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Chapter 1

Introduction

1.1 Overview

This document describes the ATMEGA32 Microcontroller kit. This board is designed to allow an easy access to all the ATMEGA32 MCU peripherals and to be easily integrated in more advanced projects. To increase its demonstrative capabilities, this stand alone board has numerous onboard resources (RS232 Interface, 7-segments Display, General Purpose Press Switches, LED's, Buzzer). This user guide acts as a general getting started guide as well as a complete technical reference for users.

1.2 Kit Features

Figure (1.1) shows the ATMega32 kit. The kit provides the following features:

- ATMEGA32 TQFP 44 device.
- Regulated 5V using External power connector.
- ICSP connector for on-chip In-Circuit Serial Programming (ICSP).
- Serial interface using RS-232 port. 4 Press Switches.
- 4 LEDs.
- 2 Seven-Segment Displays.
- Buzzer.
- Installed 8 MHz crystal.

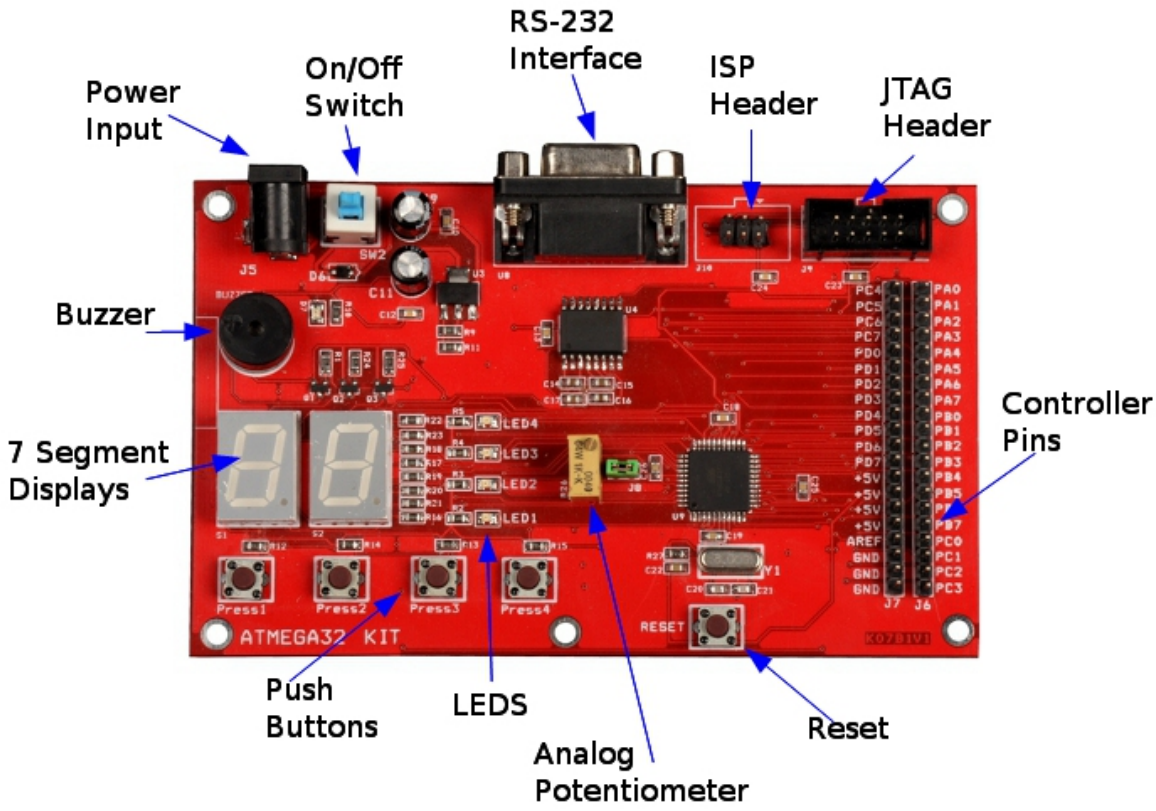

Figure 1.1: ATMega32 Kit

1.3 ATMega32 Processor

The ATmega32 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega32 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed. The kit is equipped with 44 lead TQFP ATMega32 processor.

Figure (1.2) shows a block diagram for the ATMega32 processor.

1.3.1 Memories

The AVR architecture has two main memory spaces, the Data Memory (SRAM) and the Program Memory (Is-System Reprogrammable Flash Program Memory) space. In addition, the ATmega32 features an EEPROM Memory for data storage.

1.3.2 Clock Options

Allowable Operating speed for the ATMega32 ranges from: DC - 16 MHz clock input. The kit is equipped with an 8 MHz crystal.

1.3.3 I/O Ports

32 programmable I/O lines divided into 4 ports, 8 pins each.

1.3.4 Peripheral Features

- 8-channel, 10-bit ADC.
- Two 8-bit Timer/Counters.
- One 16-bit Timer/Counter.
- Four PWM Channels.
- Programmable Serial USART.
- Master/Slave SPI Serial Interface.
- Programmable Watchdog Timer with On-chip Oscillator.
- On-chip Analog Comparator.

1.3.5 Operating Voltage

The ATMega32 processor operates from 4.5V to 5.5V.

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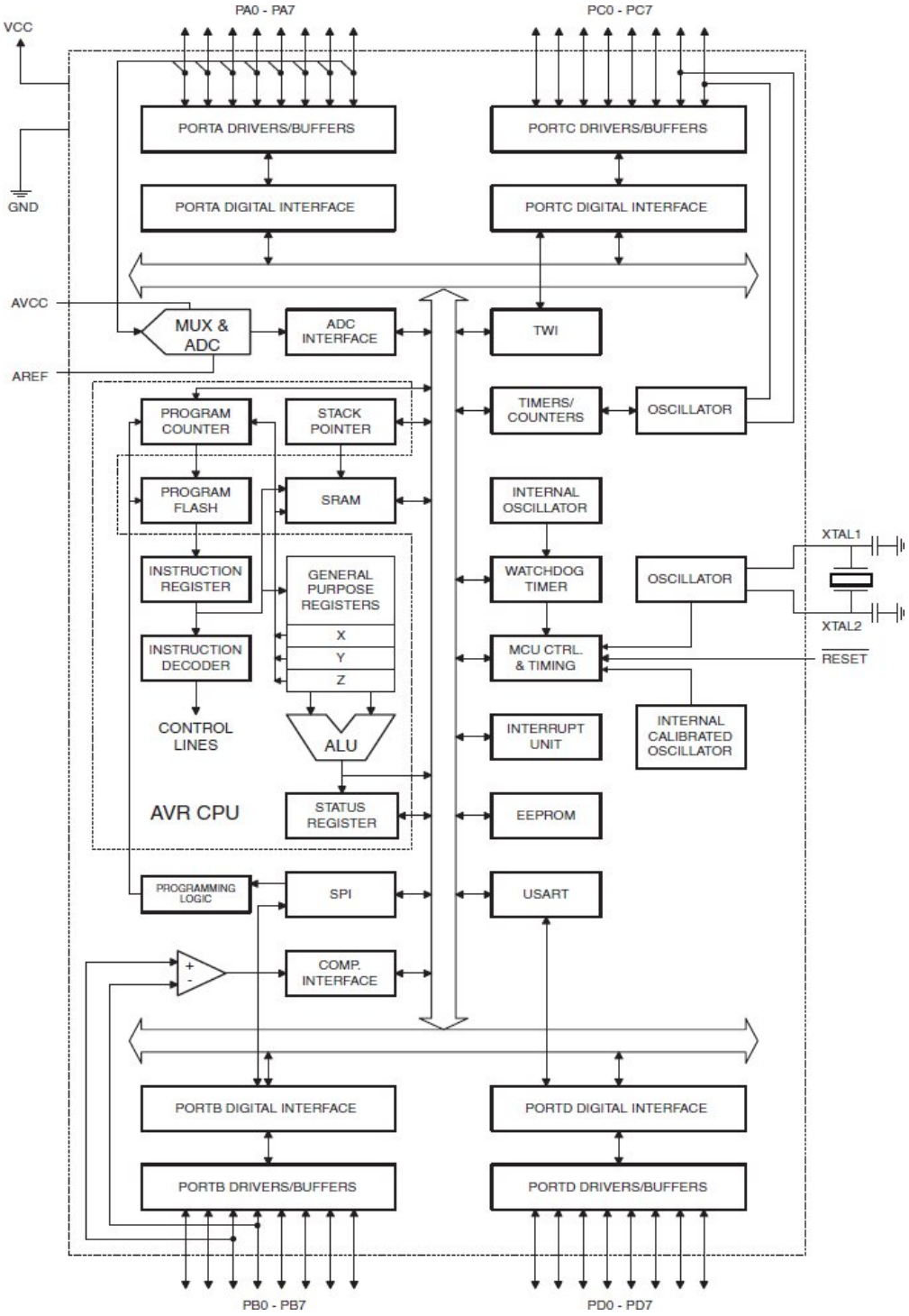

Figure 1.2: ATMega32 Microcontroller Diagram

Chapter 2

Using ATMega32 Kit

2.1 Overview

This chapter is intended to act as a quick start for using the kit. It contains information needed in order to start using the kit and experimenting with it. It is concerned with options or configurations that the user can change in order to change the behavior of the board. It can be used to run demonstration codes that can be downloaded from M3A website.

This product contains static sensetive devices. Observe proper static handling precautions when touching the product.

2.2 Power Supply

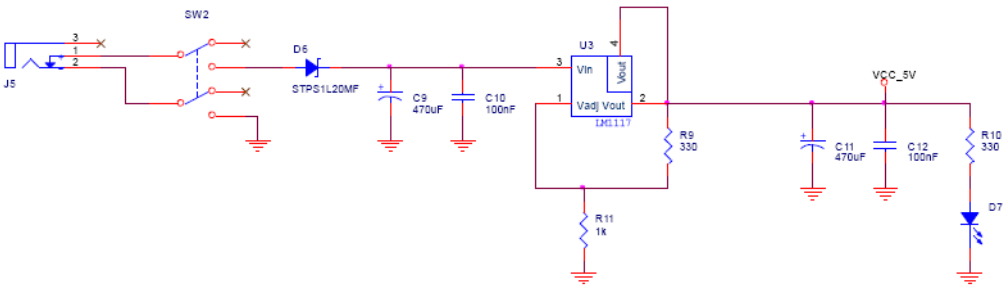

Figure 2.1: Power Supply

The on-board regulator provides a regulated 5V supply through an external DC input with a safe operation range of 7.5V up to 12V DC. An On-board power on/off switch is available. The POWER-ON LED is lit when the power switch is switched on. Figure (2.1) shows the schematic for the power supply circuit.

2.3 Jumper Configurations

The kit contains the following configuration jumpers:

J8	
Closed	PA0 is connected to analog output of R26 potentiometer
Open	PA0 can be used as a generic digital I/O

2.4 Programming The Kit

The kit supports two interface connectors for programming.

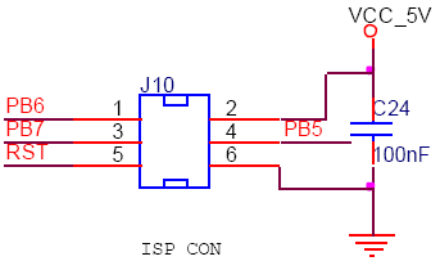

Figure 2.2: ISP Connector Pinout

- ISP (In System Programming) this can be done through J10 connector. J10 connects to the microcontroller using SPI mode. J10 is shown in Figure (2.2). It supports any standard ATMEL ISP programmer.

Caution should be exercised when programming the microcontroller fuses. Programming the fuses to use an external clock source would render the microcontroller unreachable through SPI mode.

- JTAG Connector (J9). This connector supports standard ATMEL JTAG debuggers. It can be used to connect to the microcontroller for JTAG mode for programming as well as debugging as well. Figure (2.3) shows the pinout of the connector.

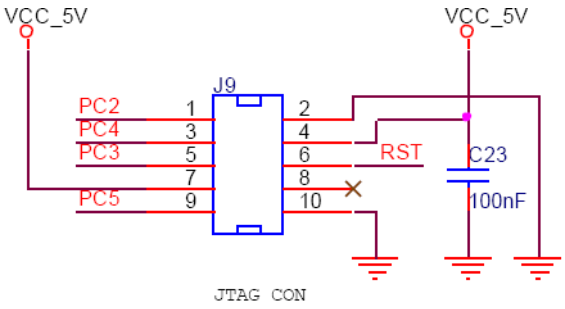

Figure 2.3: JTAG Connector Pinout

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Chapter 3

On Board Peripherals

3.1 Overview

This chapter illustrates the onboard utility perihperals that are included in the kit to help in developing applications and prototypes rapidly. Each utility is illustrated and discussed briefly.

3.2 Display LEDS

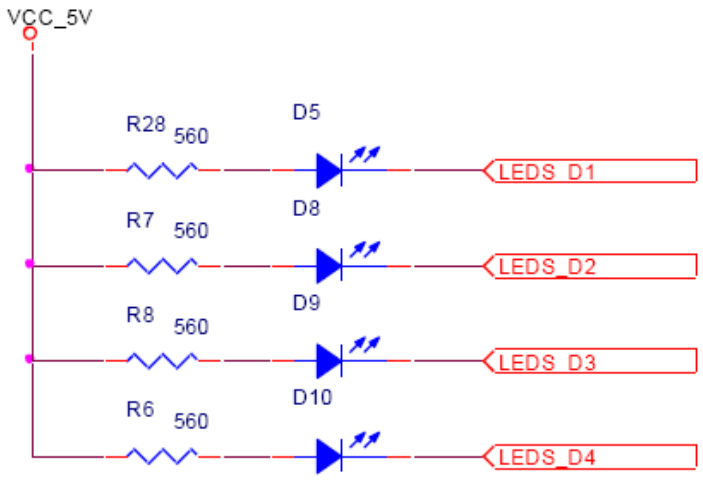

Figure 3.1: LEDS

The kit includes 4 LEDs implemented on one line. They are connected to 4 successive port pins. To light ON a LED, the corresponding port pin must be driven to LOGIC LOW level. To turn OFF a LED, the corresponding port pin must drive a LOGIC HIGH level. Figure (3.1) illustrates the schematics for LEDs part.

3.3 7 Segments

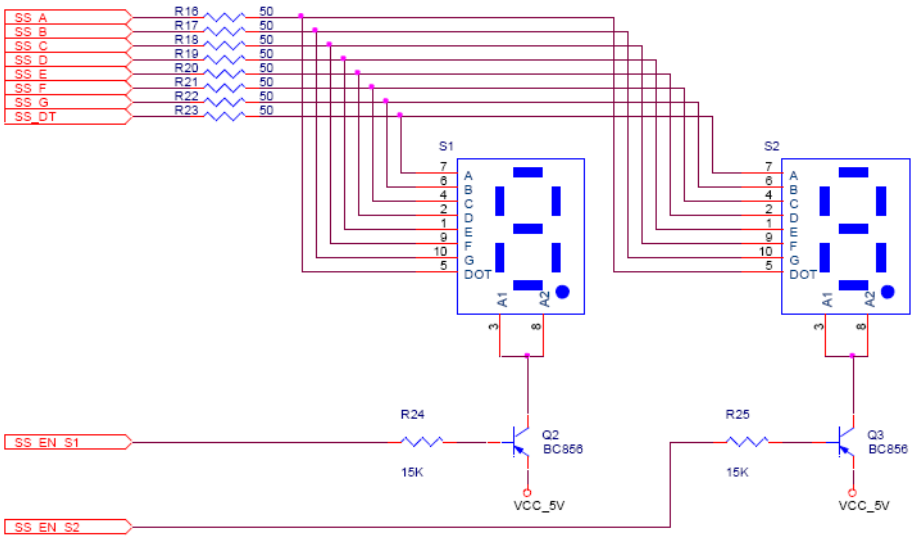

Figure 3.2: 7 Segment Displays

The kit is equipped with 2 seven segment displays. The displays are of the common anode type. Each segment is enabled through a PNP transistor. Enabling a segment is done through driving the corresponding enable pin to LOGIC LOW level. To enable a segment of the display, the corresponding pin is to be driven to LOGIC LOW level as well. The two segments are connected to the same data port for multiplexing purposes. An example usage for the seven segment displays can be downloaded from M3A website. Figure (3.2) illustrates the schematics for 7 Segments.

3.4 Buzzer

The kit is equipped with a piezo-electric buzzer. The buzzer generates a tone arround 1 KHz when enabled. The buzzer is powered through a PNP transistor. Enabling the buzzer requires the corresponding port pin to be driven to LOGIC LOW. The port pin is also selected to be a PWM output so that the fundamental tone of the buzzer can be modulated using PWM signal if required. Figure (3.3) illustrates the schematics for the buzzer part.

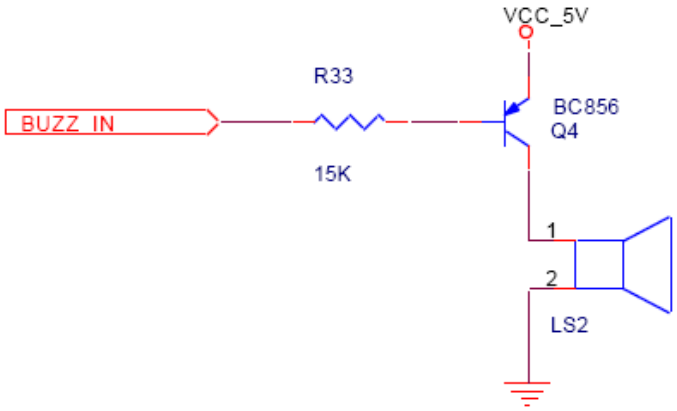

Figure 3.3: Buzzer

3.5 Push Buttons

The kit is equipped with 4 push-buttons with a normally-open state. The 4 push buttons are connected to 4 successive port pins. LOGIC HIGH level is observed on the corresponding port pin when the button is not pressed. LOGIC LOW level is observed on the corresponding port pin when the push button is pressed. Figure (3.4) illustrates the push buttons.

3.6 Analog Potentiometer

The kit is equipped with an analog potentiometer in order to generate an analog voltage. The voltage ranges from 0V to 5V. The output of the analog potentiometer is connected to a port pin through a configuration jumper.

3.7 RS-232 Serial Interface

The board is equipped with an RS-232 interface for communication with the target microcontroller using UART. The RS-232 uses the standard D-sub 9-pin connector. Figure (3.5) illustrates the circuit containing the MAX232 level translation circuit.

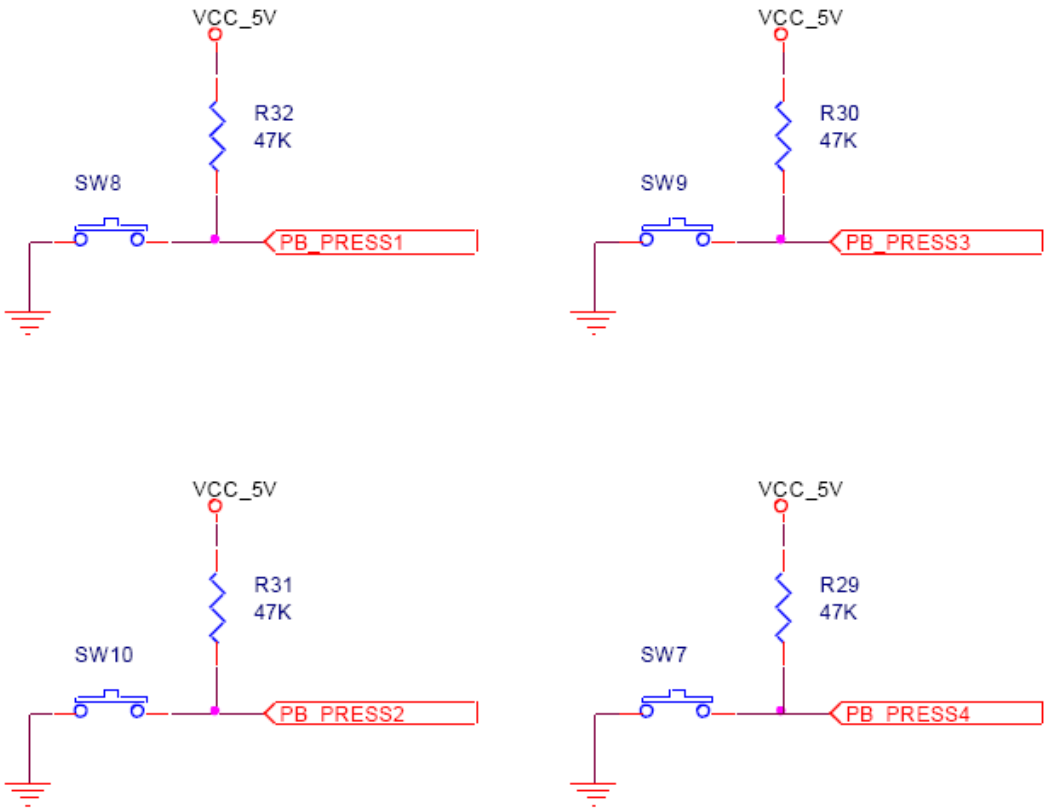

Figure 3.4: Push Buttons

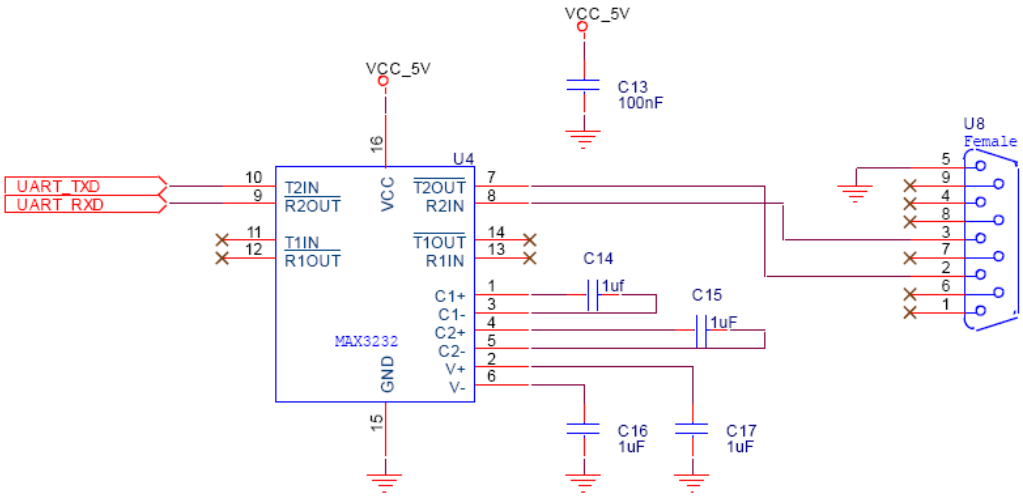

Figure 3.5: RS-232 Serial Interface

Chapter 4

Pin Allocation

4.1 Overview

This section acts as a help for firmware developer. It describes the IO pins of the microcontroller and their assignment on the on-board peripherals.

4.2 I/O Pins assignment

Pin	Functionality	Comments
PA0	Analog input from Potentiometer	J8 must be in “Closed” position, refer to section [2.3]
PA1	Enable Seven Segment ’g’	Use logic low to enable segment
PA2	Enable Seven Segment ’f’	Use logic low to enable segment
PA3	Enable Seven Segment ’e’	Use logic low to enable segment
PA4	Enable Seven Segment ’d’	Use logic low to enable segment
PA5	Enable Seven Segment ’c’	Use logic low to enable segment
PA6	Enable Seven Segment ’b’	Use logic low to enable segment
PA7	Enable Seven Segment ’a’	Use logic low to enable segment

Pin	Functionality	Comments
PB0	Push button 1	Logic low detected when button is pressed
PB1	Push button 2	Logic low detected when button is pressed
PB2	Push button 3	Logic low detected when button is pressed
PB3	Push button 4	Logic low detected when button is pressed
PB4	Not assigned	Can be accessed from pin header
PB5	Not assigned	Can be accessed from pin header
PB6	Not assigned	Can be accessed from pin header
PB7	Not assigned	Can be accessed from pin header

Pin	Functionality	Comments
PC0	Not assigned	Can be accessed from pin header
PC1	Not assigned	Can be accessed from pin header
PC2	LED 4	Use logic low to enable LED / logic high to disable LED
PC3	LED 3	Use logic low to enable LED / logic high to disable LED
PC4	LED 2	Use logic low to enable LED / logic high to disable LED
PC5	LED 1	Use logic low to enable LED / logic high to disable LED
PC6	Enable Seven Segment S2	Use logic low to enable segment
PC7	Enable Seven Segment S1	Use logic low to enable segment

Pin	Functionality	Comments
PD0	Not assigned	Can be accessed from pin header
PD1	UART TxD	
PD2	UART RxD	
PD3	Not assigned	Can be accessed from pin header
PD4	Not assigned	Can be accessed from pin header
PD5	Buzzer enable/disable	Use logic low to enable buzzer / logic high to disable buzzer
PD6	Not assigned	Can be accessed from pin header
PD7	Enable Seven Segment Dot	Use logic low to enable

Note that all controller can be accessed from pin header, even if the pins are assigned to some resource in the board.

Chapter 5

Mechanical Dimensions

Figure (5.1) illustrates the mechanical dimensions for the ATMEGA32 kit.

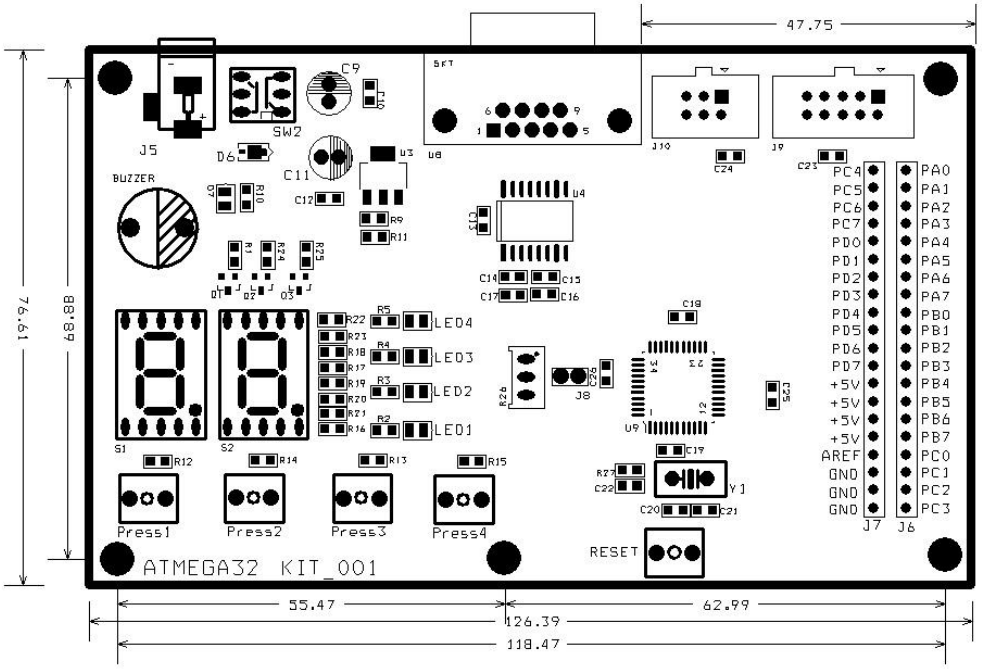

Figure 5.1: Mechanical Dimensions

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